

General Information

Introduction

The HP 85071 materials measurement software allows measurements of the complex permittivity (ϵ , epsilon) and permeability (μ , mu) for a wide range of solid materials. It performs all of the necessary network analyzer control, calculation, and data presentation functions.

In brief, the software:

- Controls the network analyzer to measure the complex S-parameters of a material sample,
- Converts these S-parameters of the sample holder/sample material to S-parameters at the sample interface,
- Calculates the complex material parameters, ϵ and μ ,
- Displays the measurement results in a variety of graphical and tabular formats,
- Facilitates these functions:
 - Printing or plotting the results,
 - Saving the results to disk,
 - Saving test setups to disk.

Calibration of the measurement system is performed manually on the network analyzer to allow full flexibility in the use of calibration kits and techniques. From this point on the software is used to calculate and analyze the constituent materials parameters.

The Software Incorporates Six Calculation Models

The following paragraphs summarize the calculation models. For details, see chapter 8, "Software Reference."

Reflection/Transmission Mu and Epsilon Nicholson-Ross Model

This is an adaptation of the classical Nicholson-Ross-Weir technique described in the literature and in Hewlett-Packard Product Note 8510-3. This technique characterizes both dielectric and magnetic properties of a material sample from reflection and transmission measurements.

Reflection/Transmission Epsilon Precision Model

This model is based on recently published work by the National Institute of Standards and Technology. It is an accurate technique which is independent of the placement of the sample in the sample holder.

Reflection/Transmission Epsilon Fast Model

This is a faster technique for characterizing the dielectric constant of a material. Both the "fast" and "precision reflection/transmission epsilon" models are immune to the sample half-wavelength calculation problems found with the Nicholson-Ross-Weir technique.

Reflection-Only Epsilon Short-Backed Model

This characterizes the dielectric properties of a material in a coax or waveguide transmission line backed by a short circuit (or bonded to a ground plane). It is simple and best for liquid or powder, or measurements.

Reflection-Only Epsilon Arbitrary-Backed Model

This characterizes dielectric materials backed by an arbitrary but repeatable termination. It is simple and best for thin film measurements.

Reflection-Only Mu and Epsilon Single/Double Model

This is the only reflection model capable of permeability measurements. It is slow and requires two measurements. It is best for liquid or powder measurements.

Items Supplied with the Software

These items constitute the HP 85071 materials measurement software:

- HP 85071 software disk (one 3.5 inch high-density, double-sided disk)
- This manual

First Steps

Before using the HP 85071 software, be sure that both of these items have been received and appear to be in good condition. Contact your Hewlett-Packard representative if either item is missing or appears to be damaged.

About this Manual

This manual is a complete guide to using the HP 85071 software to make materials measurements. As outlined below, it explains how the system works, how to set it up, how to use the software, how to check the system, and where to find reference material.

General Information introduces the idea of material measurements with a network analyzer. It explains the functions of the analyzer, computer, software, and sample holder in making measurements.

Getting Started lists required system equipment, tells how to configure, load, and install the hardware and software, and presents operator interface techniques. It also discusses display organization (data presentation, entry prompts, instructions). At this point, the user is ready to make a measurement.

Measurement Tutorial provides a general overview of the software. It also discusses calibration, sample holders and material preparation, and the data reduction models.

A step-by-step, guided example of a calibration and measurement with the HP 85071 software concludes this chapter. First-time users are urged to perform the sample measurement procedures outlined in this chapter.

Advanced Measurement Techniques describes several advanced aspects of using the software.

In Case of Difficulty presents common measurement hang-ups and solutions, error messages and what to do about them, and helpful hints.

Operator's Check is a simple procedure to check the integrity of the software.

Ordering Supplies is a list of supply part numbers. It tells how and where to order them. It also contains a bibliography.

Software Reference is designed to serve as a reference for each function and setup parameter in the software. Each menu, menu choice, and entry parameter is explained in this chapter.

Index lists the words, topics, softkeys, hardkeys, and error messages of this manual.

Glossary defines important words and concepts of this manual.

What This Manual Covers

This manual covers the software it was shipped with:

Serial number prefix: not applicable
Software revision: 1.0 or above
MS-DOS version: 3.2 or higher
Microsoft Windows version: 3.0 or 3.1
HP BASIC version: BASIC 5.0 or higher

Description of the Software

Two versions of the software allow use of either HP Vectra PC compatible or HP 9000 series 300 computers.

MS-DOS® version of the software (standard) features the clean look of the Windows environment. This version is for the HP Vectra PC and compatible machines. It uses a mouse for most commands and entries. It is not user-modifiable. (Note: Microsoft® Windows and MS-DOS® are US registered trademarks of Microsoft Corporation.)

HP BASIC version of the software (option 300) features a Windows-like presentation. This is the HP 9000 series 300 version. The user interface portion of the source code may be printed out and customized for your individual application. It uses softkey menus for most commands and entries.

The HP BASIC version may also be used with IBM-AT compatible machines (such as the HP Vectra) and an HP 82300C BASIC language processor, release II.

Software Features

- Completely controls the network analyzer.
- Guides you through the measurement sequence.
- Automatically computes ϵ and μ (permittivity and permeability).
- Offers a variety of data formats and displays.

Features New to this Revision

- Improved Nicolson-Ross model provides sample position invariance
- One-port arbitrary backed model measures thin samples accurately
- One-port permittivity and permeability reflection only model
- Air gap correction improves accuracy of transmission line methods
- Compatible with free space measurements
- Simpler user-interface

Equipment Required

The equipment required to operate a dielectric measurement system is detailed in chapter 2, "Getting Started."

Recommended Test Equipment

Test equipment is required for the other system instruments only. Refer to the appropriate manuals for recommended test equipment.